AMATEUR SATELLITE REPORT

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AO-10 to FO-12 Crosslink Reported

by Ray Soifer, W2RS

Early on August 28, 1986, SSB signals transmitted by Carl Giacomini, KH6IBA, of Maui, Hawaii, were heard in New Jersey after an epoch journey through two OSCARs, across half an earth and tens of thousands of kilometers. How this happened makes interesting telling. Having been part of a similar adventure a decade ago provides the "teller" a gratifying sense of *deja vu* and renewed enjoyment in OSCAR!

When I first heard KH6IBA through FO-12's Mode JA transponder, his signals were weak but recognizable. He was transmitting to AO-10, Mode B on its 70 cm uplink. His AO-10 downlink was at 145.906 MHz, upper sideband, about the same strength as the Mode B beacon. FO-12, approximately 29,000 km from AO-10, received the AO-10 2 m downlink as its uplink. FO-12 retransmitted KH6IBA on lower sideband on 435.895 MHz, the frequency on which I was listening. Crosslink signals were received intermittently over a period of five minutes from 0847 to 0852 UTC.

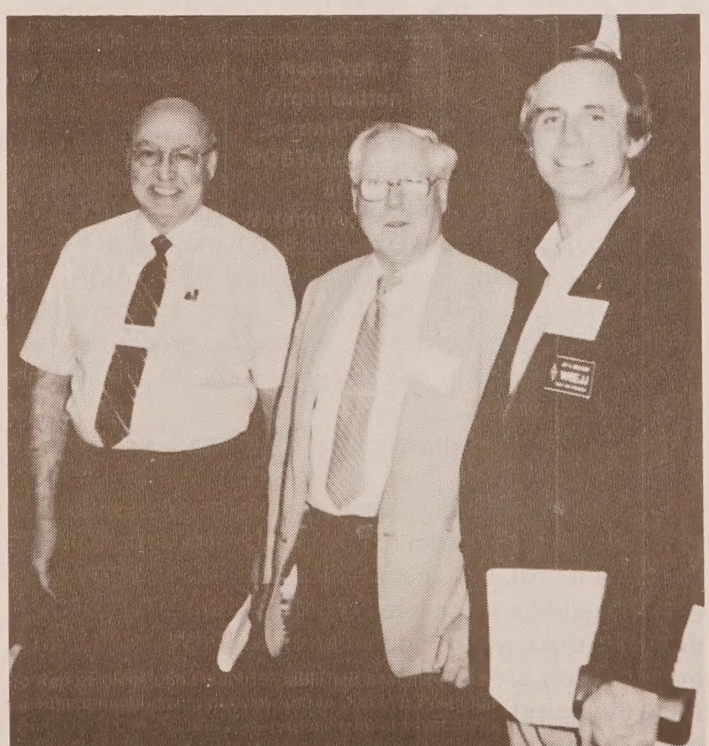
At the crosslink time AO-10 was 30,000 km over 24 degrees south, 110 degrees west; approximately over Easter Island in the South Pacific. FO-12 was passing southeastward over Mexico at 1,490 km. Its subsatellite point moved from 28 north, 109 west to 17 north, 99 west. Equipment used at W2RS included an IC-490A transceiver with a 3SK97 GaAsFET preamplifier and a KLM 432-16LB yagi antenna with rated gain of 17 dBi fed through 20 m of Belden 9913 cable (1.5 dB measured loss). The calculated system noise temperature, apart from antenna noise, was 237 degrees Kelvin.

Two-way communication via satellite crosslink was not attempted because FO-12 was not then within range of KH6IBA. However, communication was established with KH6IBA via AO-10 from 0850 to 0900 UTC during which I copied KH6IBA through FO-12 until 0852. While transmitting, KH6IBA was at times the only signal observed using the passband of either satellite; it was primarily at these times that crosslink signals were heard.

The next day WA2LQQ in New York and I attempted two-way communication via a AO-10/FO-12 crosslink. Although the effort was not successful, I did hear very weak intermittent CW signals from WA2LQQ for several seconds. I believe the difference between success and failure in this attempt was attributable to a group of strong SSB stations using FO-12 during the test. This was in marked contrast to the KH6IBA test the previous night when both passbands were virtually vacant.

The dramatic reduction in transponder power available for such a QRP AO-10/FO-12 crosslink may be seen in link calculations I later performed based on the KH6IBA test. At the extant satellite positions, an AO-10 downlink signal as strong as the beacon (2W PEP), radiating from AO-10's high-gain antenna (8 dBi) would present a signal of approximately -125 dBm to FO-12's Mode JA receiver. This assumes FO-12 antenna gain of 0 dB in the direction of AO-10.

At FO-12's range of 4,100 km from W2RS, a -125 dBm signal can be produced by an uplink signal of 2 watts EIRP. For perspective, that's approximately 100 milliwatts



Attending the Space Station Amateur Radio (SSAR) meeting in San Diego 6 Sept. were, among others, (left to right) W6SP, W3XO and W6EJJ.

transmitter power (assuming 14 dB antenna gain and 1 dB transmission line loss). While a signal of this amplitude can produce usable but marginal downlink signals with an otherwise vacant passband, sharing the transponder with several stations in the 100-500 watt EIRP class reduces the QRP downlink signal by 20 to 30 dB. That's well into the noise! Remember that the transponders are linear. Thus the available downlink power is shared based on the ratio of strengths of the uplink signals.

Hearing KH6IBA via a two-satellite crosslink recalls for me two especially memorable QSOs.

First, on January 31, 1982, I worked KH6IBA on RS-6 to complete the first-ever amateur satellite communication between New Jersey and Hawaii. This QSO also completed my satellite WAS; the first-ever such award to a New Jersey station. I had waited over seven years for a suitable opportunity having worked 49 states in 1973-74 through AO-6.

Second, in a QSO easily recalled in the context of the recent KH6IBA crosslink, on January 26, 1975, W2BXA and I (as K2QBW) completed the first QSO via satellite crosslink. It was through AO-7 and AO-6 that this historically significant QSO took place. No one (government, commerce or amateur) had ever before achieved a satellite crosslink.

Some things never change. Like the thrill of being the first to do something interesting on OSCAR!

Short Bursts

• RS-5 and RS-7 are back in eclipse until December. Present sked is RS-5 on from 0900 to 1300 and RS-7 on from 0500 to 0900 daily except Wednesdays.

• UA3CR will be traveling to Antarctica later this month. Departing in mid-October, Leo will be operating maritime mobile on 14.182 MHz while in transit. His itinerary includes EA8 and CX with a planned arrival in Antarctica of 25 December. Callsigns to be used include UK3KP, EK3KP, 4K1KP, UA3CR, EK3CR and 4K1CR. He will be experimenting with the SARSAT/COSPAS emergency locator transmitter system and may even uplink messages to UO-11's Digital Communications Experiment (DCE).

• AMSAT is a co-sponsor of the 33rd Annual Meeting of the American Astronautical Society October 26 to 29 in Boulder, Colorado. Hosted by the University of Colorado, there will be professional speakers from major space agencies from around the world. They include NASA, AIAA, ESA, CNES, NASDA and the DFVLR among others. Call 703-866-0020 for information. A program brochure which describes the event was recently sent to all AMSAT members.

• Following initial shipment of the new C-128 ORBITS tracking program, a "bug" was discovered which results in corruption of tracking data when the month of December is selected. This problem has been corrected commencing with disk ID No. 007. Replacement disks have been mailed at no additional charge to those persons to whom the defective disks were shipped. The original, defective disk may be safely used until the new replacement is received, since the defect will not manifest itself until an attempt is made to specify a December time period.

• One of the SA AMSAT members will be operational from Gough Island on hf and FO-12 from October 3 until October 23. Kalie, ZS6AEN, will be using a ZD9 call. Permission has been received from the UK administration. The actual callsign to be used will be determined in the next few days. QSL for FO-12 contacts via SA AMSAT QSL Bureau, P.O. Box 7354, Roggebaai, 8012, South Africa.

AO-10 Heading For the Last Roundup!

According to all available sources, AO-10 has had the biscuit. The rate of memory cell failure has reached a very high level with dozens of additional locations failing daily according to AMSAT DL sources. DB2OS has been working to analyze the failures in recent days. He's had to give up trying to rewrite the software because new cells were failing too rapidly.

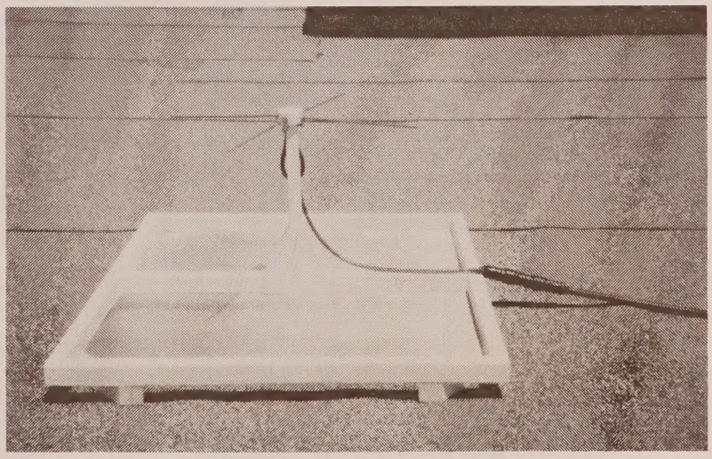
WØPN recently tried several thousand IHU reset commands without success. This was seen as another indicator of the sad condition of AO-10.

It now is certain that AO-10 is lost for the present with no chance of recovery. The only slim hope is that certain poorly understood effects in the IHU memory will reverse the course of the memory deterioration and that control can be regained when sun angles recharge the batteries later this year. Estimates place the low ebb of solar power at approximately mid-October.

Events, Programs Postponed Due to AO-10 Demise

Several projects have been cancelled and others placed on "hold" because of the imminent demise of AO-10 anticipated later this month.

Placed on "Hold" are the ZRO Memorial Receive Sensitivity Tests and Project Linkup. The latter was poised to demonstrate the delivery of bulletins via Mode L FM broadcasts to certain selected test repeaters across the continent. Preliminary tests last spring from a special Mode L test facility at WA2LQQ demonstrated FM capture in a very small Receive Only terminal. According to WA2LQQ, both the ZRO Tests and Project Linkup will be re-initiated with Phase



KH6FMT's turnstile for FO-12's 70 cm downlink is entirely homebrew. The ground plane is 20 inches square of aluminum screen on a wooden frame. The elements are 1/8 inch bronze welding rods threaded to 6-32 into a block of plastic. Elements are 6.80 inches long. The quarter-wave phasing section of RG-62A (90 ohms) was dipped at 435 MHz. The crossed dipoles are elevated 3/8 wave (10.2 inches) over the ground plane as recommended in the *ARRL Handbook* for maximum horizontal coverage.

3C next autumn. Project Linkup will transition to Mode S, FM, however, as no Mode JL FM broadcasts are contemplated. Mode JL ACSSB and perhaps digitized voice experiments as part of project Linkup are a distinct likelihood according to WA2LQQ.

The 25th Anniversary Operating Event planned earlier this year to coincide with the anniversary celebrations of OSCAR-1 this December have also been cancelled. The sole satellite remaining in regular operation is FO-12 and AMSAT believes that since it will be in heavy eclipse for much of that period, it would be wise to avoid promoting the extra heavy use an operating event of the nature contemplated would promote.

On the other hand, Ray Soifer, W2RS, has suggested a 25th Anniversary Satellite Experimenter's Club Award. It would be simple to obtain and would not endanger FO-12. Award criteria are now being evaluated. Expect an announcement on this new, one-time award very soon.

ASR *Spotlight On:* *PAT GOWEN, G3IOR*

by Pete Killingsworth, KD7WZ

Pat Gowen, G3IOR, is retired from his position at the University of East Anglia where he worked as a biophysicist for 15 years. He lives in Norwich, England with his wife, Norma, an accomplished artist, and their 100 year-old pet tortoise, Kostenorka, an accomplished survivor.

Pat has been an Amateur Radio operator since 1952. He first became interested in satellites when tracking Sputnik I in 1957. Pat became seriously active on satellites beginning with AMSAT OSCAR 6 when he felt the need to, "Get away from the increasing rat race of hf competitiveness." He was also interested in using VHF and super-MUF frequencies for DX communications and in studying propagation abnormalities of signals propagated above the F2 layer.

Pat went on to become a legend in the Amateur Satellite community making thousands of contacts through every satellite available and receiving many awards in the process. Some of his more notable achievements include the first Satellite DXCC in Europe; first OSCAR 1000 award; confirmed satellite contacts with 147 countries (134 of which were via Phase II birds); all states; all VE and all VK call areas and a gold medal from the USSR for satellite activities.

Pat founded AMSAT-UK and served as its President. He served on the AMSAT Board of Directors and as AMSAT coordinator for Europe as well as liaison with IARU Region I. He was the editor of "Oscar News" for many years, wrote a column called "Worldwide Satellite Activity" for *Orbit* magazine and currently writes a monthly column on space and satellites for *Practical Wireless* magazine. Pat is a prolific lecturer and has given over 500 talks on AMSAT and OSCAR all over Europe.

He prefers to operate CW because, "Morse code represents an international language and is better for weak signal communications." He says the most exciting facets of amateur radio are, "Achieving the [technically] 'impossible' and discussing matters with those of different ethnic and cultural backgrounds to assist global understanding."

Pat describes his OSCAR station as "more antique than unique" and says that most of his gear is either homebrewed or modified equipment. He uses a "much changed" IC-201 for 2 meters, an IC-402 for 70 cm, an IC-720A with converters and a homebrew 2 meter amplifier. He also built all his antennas.

Pat says his biggest shock in amateur radio was once when tuning below 14 MHz he heard a station calling "CQ MARS". . . and there was a reply! (At that time he was unaware of the Military Amateur Radio Service.) He also tells about the time he spent a week listening to what he thought was his transponded signal from AO-8 until he realized it was only a spurious emission, a mixer product. That experience taught him to never listen to the obvious, but to spread the search for alternatives. He says this lesson applies socially, politically and environmentally as well as to satellite signals.

Pat would advise new satellite users to "Please attend to maximizing your receivers and downlink antennas and minimizing your noise factors and transmit power. It is less expensive and is better for both you and every other satellite user."

Pat is an enthusiastic supporter of Mode A satellites since he feels more countries can be active on them particularly those in the Third World. He says equipment for 70 cm, 23 cm, etc., is in very short supply in the non-western world as is UHF/SHF talent. He believes that for true internationality and lots of world wide participation, we need to employ modes that can be used by the most people. He emphasizes that many countries do not even have allocations for UHF and SHF. Pat states that Mode A satellites are particularly useful in the "quiet sun years," since they maintain amateur use of 10 meters, preventing commercial intrusion and takeover.

A firm believer in Amateur Radio as a means for promoting international harmony, Pat says, "The amateurs of the world stand a better chance of international cooperation than the politicians. We should join our technology and launch capabilities to the benefit of the world community."

Name New Software Exchange Manager

AMSAT HQ has announced the appointment of Paul Roemer, KG6LC, of Manchester, N.H., as Manager, AMSAT Software Exchange. Paul replaces Bob McGwier, N4HY, who asked to be relieved so he could spend full time supporting the special Phase 4 Engineering Study Team effort (See *ASR* 133). Paul will be responsible to assure adequate supplies of AMSAT software are available for conventions and hamfests. He will coordinate the activities of a half dozen various software package managers who are expert in a particular system. Congratulations to Paul on his assignment.

Thanks go to Bob for his superb efforts as software developer and exchange manager. Bob developed the now-famous MAPTRAK program and applied a special algorithm (called Newton's method for finding zeroes) in his QUIKTRAK program to speed it up several fold.

Paul becomes the third Software exchange manager. Prior to N4HY, Bob Diersing, N5AHD, held the spot.

FO-12 Operation

by JR1FIG

JARL's Gijutsu-Kenkyuusho (Research Laboratory), which is responsible to operate FO-12, has decided to switch off the FO-12 transmitters on MONDAY and FRIDAY every week. This schedule will continue during long eclipses (more than 20% long) to charge the Ni-Cd battery in the satellite.

The eclipse ratio will decrease at the beginning of October. At first, another test of JD-mode was planned during this period. However, there is some difficulty in stable commanding and loading programs to FO-12. This means we have to improve the command system first. The JAMSAT/JAS-1 development team still hopes to transmit PSK telemetry during the Sep 28 to Oct 10 time frame.

Eclipse ratio for FO-12

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86/10/01(  9 %) *********
86/10/03(  4 %) ****
86/10/05(  7 %) *******
86/10/07( 11 %) ***********
86/10/09( 16 %) ****************
86/10/11( 19 %) ******************
86/10/13( 23 %) ************************
86/10/15( 24 %) ************************
86/10/17( 27 %) ****************************
86/10/19( 28 %) ****************************
86/10/21( 29 %) *****************************
86/10/23( 30 %) ******************************
      (The ratio is 26 - 30 % throughout this period)
86/12/04( 30 %) ******************************
86/12/06( 30 %) ******************************
86/12/08( 30 %) ******************************
86/12/10( 28 %) ****************************
86/12/12( 27 %) ****************************
86/12/14( 25 %) ************************
86/12/16( 22 %) **********************
86/12/18( 17 %) ****************
86/12/20(  7 %) *******
86/12/22(  0 %)
86/12/24(  0 %)
86/12/26(  0 %)
86/12/28(  0 %)       You all can have wonderful
86/12/30(  0 %)       x'mas/new year holiday !!
86/01/01(  0 %)
86/01/03(  0 %)
86/01/05(  0 %)
86/01/07(  0 %)
86/01/09( 16 %) ****************
86/01/11( 21 %) ********************
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Report On New UoSAT Operations Schedule

by the University of Surrey UoSAT Team

On 21 August, several members of the UoSAT team at the University of Surrey met to discuss an operations plan and an operating schedule for UoSAT OSCAR 9 and 11. To understand how the schedule was decided upon, it is important to know the background to current UoSAT operations.

Until 1985, switching the downlink data content on either satellite meant loading a new program to the On Board Computer (OBC) or otherwise commanding the satellite from the ground. For several years, programs were loaded into UO-9 daily providing a consistent, varied downlink schedule for educational and Amateur Radio groundstations, while also providing researchers at UoS with the data that they needed. The major drawbacks to this procedure were that the downlink data only varied on a day-to-day (not minute-to-minute) basis and that the implementation of the schedule depended on UoSAT staff and equipment being available each day to load software to the OBC. UoSAT staff spent a lot of time uploading software to the satellite.

When Steve Holder joined the UoSAT team, one of his first tasks was to design and implement a DIARY program which would automate the selection and rotation of downlink data contents without requiring daily intervention by the UoS ground command station. This program was first run on UO-11 and is now in place on UO-9. The DIARY programs are quite flexible, providing (in addition to other advanced facilities) a timed rotation of downlink data sources. A typical rotation includes several minutes of Whole Orbit Data (WOD), a couple of passes through the Bulletin, some telemetry and some OBC status messages. Thus, in a single pass, a groundstation can hear some data from several of the onboard experiments. The DIARY can be programmed days, weeks or months in advance, so the schedule does not depend on UoS commanding the satellite every day. Used correctly, the DIARY should be able to provide a predictable, interesting schedule to Amateur Radio and educational groundstations, while allowing UoS experimenters to concentrate their energies on experimenting and not on daily satellite operations. It is in this context that the new UoSAT Operations Schedule was drawn up.

The interests of several groups of "UoSAT users" were kept in mind during the formulation of the Schedule. Those outside of UoS have indicated that they want a predictable UoSAT schedule, but there is a wide range of opinion about what data formats or sources are most desirable. Stations using the UoSATs as educational aids (or simply to bring satellites to a wider audience), are interested in the DIGITALKERs; those that want detailed data find the DIGITALKER a waste of time. Many people are interested in the CCD camera experiments. Advanced experimenters would like to get a chance to listen to the UO-11 high-speed downlink or the 2-GHz beacon. These subgroups within the user community are "contending" for a fixed amount of downlink time.

The engineers within UoS also have needs. Most of them want lots of data from a specific experiment at a specific — but often unscheduled — time. Those involved in the Digital Communications Experiment need access to the UO-11 uplink and downlink on a regular basis and are interested in allowing selected groundstations worldwide to participate in the DCE network. The Schedule has to balance these diverse desires with the capabilities of UO-9 and UO-11.

It is obvious to those who listen to and work with the UoSATs that both satellites are alive and well — fulfilling or exceeding design expectations. It is equally obvious to those who look deeper that each satellite has strengths and weaknesses.

First, the weaknesses:

* The OBC on UO-9 has difficulty reliably commanding other parts of the spacecraft.

1986 Annual Meeting Prize List

Prize Category	Prize	Donor
Grand Prize	ICOM IC-1271A 1.3 GHz Xcvr	ICOM America, Bellevue, WA
Banquet Digital	AEA Model AMT-1 AMTOR/RTTY	AEA, Lynwood, WA
Banquet Deluxe	Yaesu FT-727R 2m/70cm HT	Yaesu USA, Cerritos, CA
Early Registrant	ALINCO ALM-203T 2 meter HT	Alinco, Reno, NV
Banquet Dish	Continental Satellite 10' Dish	Cont. Sat., Clackamas, OR
Banquet GaAs	Landwehr 2 m mastmount GaAsFET	Henry Radio, Los Angeles
Banquet GaAs	THL HRA-2 2 m mm GaAsFET	Encomm, Plano, TX
Banquet GaAs	ARR SP432VDG 2 m mm GaAsFET	ARR, Burlington, CT
Banquet GaAs	Lunar PAG432 GaAsFET	Lunar, San Diego, CA
Banquet Alum	Cushcraft 416-TB 70 cm X-yagi	Cushcraft, Manchester, NH
Banquet Alum	F9FT 1.3 GHz X-yagi	PX Shack, Bellemead, NJ
Banquet Alum	KLM 1.2-44LBX 1.3 GHz yagi	KLM/Mirage, Morgan Hill, CA
Banquet Alum	23-45LY 1.3 GHz loop yagi	Downeast Microwave, ME
Banquet Special	Daiwa NS-663A/N SWR/PWR meter	Hardin Elect, Ft Worth, TX
Banquet Special	Pair of 3CX100A5 tubes	Eimac, Dallas, TX
Banquet Special	Welz SP-15M SWR/PWR meter	ECI, Dallas, TX
Banquet Special	100' Belden 9913 w/connect.	ECI, Dallas, TX
Banquet Special	$50 gift certificate	Nortex, Ft Worth, TX
Banquet Special	Free room for 2 nights	DFW Hilton Hotel

* UO-9 is not always pointing toward the earth, so communications links to the satellite are highly variable.
* UO-9 cannot have both of its beacons on at the same time!
* UO-11's most annoying limitation is related to the UoS groundstation: Because of limited uplink EIRP, UoS cannot always upload large programs to UO-11 if both the 70-cm and 2-m beacons are on.
* Similar limitations mean that low-power DCE groundstations cannot access the DCE if both beacons are on.

Now, the strengths:

* The UO-9 CCD camera is providing good image data and hardware and software are available for receiving and decoding these transmissions.
* The UO-9 radiation experiment provides unique and interesting data.
* The UO-11 two-metre and 70-cm downlinks can be on simultaneously.
* UO-11 has a large OBC memory for bulletins and WOD.
* Commanding or reloading UO-11 is very easy, because the satellite pointing toward the earth at all times and the OBC command port is reliable.
* Greater deviation on the UO-11 downlink should make the UO-11 DIGITALKER easier to receive than that on UO-9. (This has not been tested yet.)

THE SATELLITE SCHEDULES
UO-9

* UO-9 will be scheduled on a monthly basis. After asking for comments from the UoSAT user community, we decided not to have a weekly bulletin on UO-9, but to only reload the UO-9 DIARY program monthly. This relieves the UoS groundstation from having to reload UO-9 each week. As regular listeners will know, this reloading often stretched over several days, causing regular interruption of the schedule. As a result of the change to a monthly schedule, the UO-9 schedule will be more reliable.
* The "bulletin" portion of the UO-9 DIARY rotation will carry the month's schedule. This will include a list of the scheduled WOD surveys, a description of the DIARY rotation and any special events scheduled for particular days of the week.
* The HF beacons on UO-9 will be on every day. This is in response to several requests for more HF beacon activity but will depend on the UO-9 power budget.
* CCD pictures will be transmitted on UTC Wednesdays. The pictures will be taken the previous Thursday. Information about when the picture was taken will be loaded into the DIARY Newsflash.
* A new WOD survey will begin each day. Some surveys will begin at UTC midnight, while others will be scheduled for equator crossings or other interesting times. WOD channels will be selected to provide interesting engineering data.
* On three consecutive days per week (probably Saturday, Sunday and Monday), WOD surveys will include the Radiation Experiment (ch. 3) and channel 13 which monitors its High-voltage power supply.
* UO-9 will be turned off by the OBC on Thursday afternoon UTC. The UoS groundstation will use this "window" to take CCD pictures, modify the schedule, load "Newsflash" bulletins and (monthly) reload the DIARY. If the DIARY is not being reloaded, the satellite should only be off for one pass over UoS.

UO-9 SCHEDULE

Saturday	WOD (w/ Radiation Expt.)/TLM/SKED/STAT
Sunday	"
Monday	"
Tuesday	WOD/TLM/SKED/STAT
Wednesday	WOD/TLM/SKED/STAT/CCD
Thursday	Satellite turned off around 1500 UTC
Friday	WOD/TLM/SKED/STAT

HF Beacons - daily.
(SKED = Monthly schedule; STAT = OBC status messages)

UO-11

* The DIARY schedule for UO-11 is designed to take advantage of easy uploading and large memory. The experiment schedule includes both the 2-GHz and 70-cm downlinks, for the first time. The 70-cm downlink will carry a mixture of the normal DIARY output at 1200 bit/sec and output from the Data Store and Readout module at 4800 bits/sec. This should encourage a wide range of experimentation. Details of the schedule are:
* Bulletins, containing news of interest to the Amateur Satellite and Satellites In Education communities and up-to-date Keplerian elements, will be loaded weekly. More frequent updates will be made as necessary.
* The DIGITALKER, now absent from the UO-9 schedule, will be placed in the UO-11 rotation on UTC Wednesdays, primarily for school demonstrations. This will probably not happen until October because the software must be written and tested. It will be worth the wait though, since the higher deviation on the UO-11 FM downlinks will mean a much clearer DIGITALKER signal, and the UO-11 DIGITALKER has a larger vocabulary than that on UO-9.
* Wednesday will see both the 70-cm and the 2-m beacons on. The 70-cm beacon will carry a mixture of 1200-bit/sec DIARY data and 4800- bit/sec DSR data. The DSR data will be either scientific data, CCD images or data from the particle/wave experiment but is intended mainly for those testing demodulator designs. There is no readily available demodulator for this signal. We hope that scheduled 4800 bit/sec transmissions will stimulate interest, perhaps resulting in a demodulator design being published and further DSR/CCD time being scheduled.
* The 2-GHz beacon will transmit on UTC Saturdays beginning in October. We encourage experimenters to send us reports of SHF beacon reception.
* WOD channels will be selected with an eye toward interesting combinations of telemetry points. UoSAT users should write in with their "WOD requests."

UO-11 SCHEDULE

Sunday	DIARY (WOD/TLM/STAT/BULL)
Monday	"
Tuesday	"
Wednesday	DIARY and DIGITALKER (when ready) and "70-cm day"
Thursday	Load Bulletin during the morning (UTC). DIARY
Friday	DIARY
Saturday	DIARY and 2-GHz beacon

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Pat, G3IOR, working OSCAR in the shack, see related story inside.

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